Anaktuvuk Pass Vegetation Study

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INTRODUCTION

Anaktuvuk Pass is a Nunamiut Eskimo village located on the continental divide in the central Brooks Range (N 68° 08', E 151° 46'). Approximately 300 people live a subsistence lifestyle, with caribou, moose, Dall sheep and fish representing a large proportion of their diet. All-terrain vehicles, primarily ARGO's (8 wheel drive vehicles) are used to access areas around the village during the spring, summer, and fall months. These vehicles are capable of driving over the roughest terrain, thereby opening many otherwise inaccessible areas to subsistence and/or recreational activities.

The third year of a study investigating all-terrain vehicle (ATV) impact on tundra vegetation was conducted from 24 June to 12 August 1997 near Anaktuvuk Pass, Alaska (Shea 1994, McKee and Irinaga 1995, McKee 1996). This study is in conjunction with a land exchange proposal between the U.S. National Park Service and The Arctic Slope Regional Corporation. The primary objective of this study is to collect baseline data on various habitat types to facilitate monitoring the resistance and resiliency of these habitat types to ATV use. Results from this study will serve as a general resource data base for the area and be used to make management decisions minimizing ATV use impacts.

STUDY AREA

The study was conducted near Anaktuvuk Pass, in Gates of the Arctic National Park and Preserve (GAAR), central Brooks Range, Alaska. Sample sites were located along the John and Anaktuvuk Rivers as well as several tributary creeks (Figure 1). The area is dominated by an arctic climate with a mean summer high temperature of 60°F and a mean winter low of -10°F. Annual precipitation is less than 25 cm. The dominant vegetation type is tundra. Cottonsedge tussocks (Eriophorum spp.) dominate much of the landscape with mosses and lichens growing in between tussock clumps. Other plants include grasses (Calamagrostis spp., Festuca spp., Arctogrostis spp.) and small shrubs (Betula nana, Salix spp., Ledum palustre), with several herb species being locally abundant in many areas (National Park Service 1986).

METHODS

Fieldwork was conducted by a biological technician and a field assistant based out of Anaktuvuk Pass; the technician was a plant specialist and the field assistant conducted soil sampling and served a support role (carrying gear, data recording, etc.). Study plots were accessed by foot and float plane.

Fifty-five 5m x 3m baseline plots were established and sampled during the 1997 field season. Twelve plots were located in the Anaktuvuk River/Graylime Creek area, thirty-four plots were located along the Masu and Ekokpuk Creek drainage's, and the remaining nine plots were located on Giant Creek (Figure 1). A pilot study of impacted areas was also conducted on Kollutaruk Creek in which twenty-one plots were established in two different habitat types. All of the plots were surveyed with a Global Positioning System and the latitude/longitude logged for future reference (Tables 1-3). A standardized form was used for data collection (Appendix A). All of the plots were characterized to level IV of Viereck et al. (1992), and soil data, slope, aspect, depth to permafrost, and moisture content were also recorded. This information was put into a computer database for analysis. Additionally, a Disturbance Rating Scale was given to each site to quantify existing ATV impacts in these areas (Appendix B). This scale was only applicable to the pilot study since all baseline plots represented pre-argo conditions.

Soil data collection was modified from the original protocol (Shea 1994) to simplify our effort. A soil pit was dug next to each plot with a Sharpshooter shovel until permafrost was reached or until substrate content prevented furthur digging. Soil horizons and texture were determined and organic layer thickness was measured (Tables 4-6). In addition, surficial geology, topographic position, and flooding frequency of the plots were identified. A fixed area plot design was used to sample vegetation and to estimate percent cover of plants. All vascular plants within the plots were identified to species and percent cover was estimated for each. Plant nomenclature followed Hulten (1968). Lichens were identified only when they accounted for 20 percent or more of the ground cover within a given plot, and then only those species representing 5 percent or more cover were identified. Bryophyte species were not identified but their percent cover was recorded. Plots were randomly delineated using a random number table.

In addition to establishing baseline and pilot study plots, photographic documentation of ATV impacts was also begun. Photos were taken of impacted areas whenever they were encountered during day hikes to and from plots or during hikes into or out of a particular drainage. An attempt was made to take photos in as many different habitat types as possible. Photo locations were recorded on topographic maps (scale 1:63, 360).

RESULTS

The most abundant habitat sampled was open low mixed shrub-sedge tussock tundra (IIC2a). This type was sampled in plots AKP034, AKP035, AKP036, AKP037, M004, M005, M006, M007, and M008 (Fig. 2-3). These plots were dominated by the tussock forming sedges Eriophorum vaginatum and Carex bigelowii. Common shrubs included Salix pulchra, S. reticulata, Betula nana, Vaccinium vitis-idaea, and Empetrum nigrum. Forbs other than the tussock forming species were scarce and rarely made up more than 1 percent of the cover in any given plot. Mosses were common, accounting for 10 to 55 percent of ground cover at these sites. Lichens were generally absent or present in small amounts. Soil profiles for these plots had a well-developed organic layer 9 to 16 cm thick over mineral soil. Frozen soil was found at depths of 24 to 37 cm on 28 June (n= 4) and 28 to 43 cm on 11 July (n= 4).

Open low willow shrub (IIC2g) was sampled in plots AKP032, AKP033, G008, G009, M019, M020, M021, M022, and M023 (Fig. 2-4). These sites were dominated by the shrubs Salix pulchra and S. glauca. Other common shrubs included Salix reticulata, S. lanata, Vaccinium uliginosum, and V. vitis-idaea. Forbs such as Carex bigelowii and Pyrola grandiflora were locally abundant at some sites but most were usually present in amounts <1%. Mosses were common, accounting for 33 to 58 percent of ground cover. Lichens were generally scarce, although at plot M020 they accounted for 20 percent of the cover, with Stereocaulon sp. making up 15 percent of the ground cover in this plot. Soil profiles for these plots included a 3 to 13 cm organic layer over mineral soil. Frozen soil was found at depths of 28 to 37 cm on 12 July (n= 7).

Tussock tundra (IIIA2d) was sampled in plots G001, G002, G003, G004, G005, G006, and G007 (Fig. 4). These communities were dominated by the tussock forming sedges Eriophorum vaginatum and Carex bigelowii. Low shrubs growing in between the tussocks included Salix pulchra, Ledum palustre, and Cassiope tetragona, but these made up less than 10 percent of ground cover at these sites. Forbs other than the tussock forming species were scarce. Mosses were locally abundant at some sites but were usually sparse. Lichens were minimal or nonexistant. Soil profiles for these plots included a well-developed organic layer 10 to 25 cm over mineral soil (n= 7). Frozen soil was found at a depth of 20 to 28 cm on 24 June (n= 7).

Dryas-sedge dwarf shrub tundra (IID1b) was sampled in plots AKP038, AKP039, AKP040, AKP041, AKP042, and AKP043 (Fig. 2). These sites were dominated by Dryas integrifolia, and also had a strong sedge component of Carex scirpoidea. Dwarf willow Salix reticulata was common and forbs (Hedysarum alpinum, Silene acualis, and Astragalus alpinus)were locally abundant at some sites. Mosses were generally absent. Lichens were common and at plot AKP043 the lichen Asahinia chrysantha made up 5 percent of the ground cover. Soil profiles for these plots included an organic layer 3 to 6 cm over mineral soil. Depth to frozen soil could not be determined because of the rocky substrate at these sites.

Wet sedge meadow tundra (IIIA3a) was sampled in plots EK034, M009, M10, M011, M026, and M027 (Fig. 3). These plots were dominated by the sedges Eriophorum angustifolium and Carex aquatilis. Shrubs were usually absent, although Salix lanata and Vaccinium uliginosum were locally abundant at some sites. Forbs other than the tussock forming species were scarce. Mosses and lichens were absent. Soil profiles for these sites consisted of a well-developed organic layer 10 to 20 cm over mineral soil (n= 3), although some sites had only a thin organic layer of 1 to 3 cm (n= 2). Frozen soil was found at depths of 30 to 57 cm on 11 July (n= 4).

Closed willow shrub (IIC1b) was sampled in plots EK028, EK029, EK030, EK031, EK032, and EK033 (Fig. 3). These plots were dominated by the willows Salix lanata and S. pulchra. Other shrubs common in the understory included Salix reticulata and Vaccinium uliginosum. The forb Astragalus alpinus was the only abundant forb in the understory. Mosses were common, accounting for 10 to 18 percent of ground cover. Lichens were scarce. Soil profiles for these sites consisted of an organic layer 4 to 17 cm thick over mineral soil. Frozen soil was found at depths of 27 to 32 cm on 14 July (n= 6).

Dryas dwarf shrub tundra (IID1a) was sampled in plots M012, M013, M014, M024, and M025 (Fig. 3). These communities were dominated by Dryas integrifolia. Shrubs were not common except for the dwarf willow Salix phlebophylla. Forbs were present only in small amounts. Mosses were scarce and lichens were common, although no one species of lichen made up >5% of ground cover. Soil profiles for these sites consisted of mineral organic layer 1 to 3 cm thick. Depth to frozen soil could not be determined due to the rocky substrate of these sites.

Open tall willow shrub (IIB2a) was sampled in plots M15, M16, M17, and M18 (Fig. 3). These communities were dominated by the willow Salix alaxensis. Other shrubs common in the understory were Salix lanata, Vaccinium uliginosum, Arctostaphylos rubra, Shepherdia canadensis, and Potentilla fruticosa. The forbs Astragalus alpinus, Hedysarum alpinum, and Pyrola grandiflora were locally abundant at some sites. Mosses were common, accounting for 34 to 51 percent of the ground cover. Lichens were scarce. Soil profiles for these sites consisted of an organic layer of 3 to 11 cm thick over mineral soil. Depth to frozen soil could not be determined for these plots because of the rocky substrate.

Open low mesic birch-ericaceous shrub (IIC2c) was sampled in plots M001, M002, and M003 (Fig. 3). These communities were dominated by Betula nana and the ericaceous shrubs Vaccinium vitis-idaea, Arctostaphylos rubra, and Empetrum nigrum. Other shrubs present in the understory included Ledum palustre and Vaccinium uliginosum. Forbs such as Hierchloe alpina and Carex podocarpa were present in most plots, but usually represented less than 1 percent of the ground cover at these sites. Mosses made up 5 to 10 percent of the ground cover. Lichens were common and even codominant at some sites. Common lichens included Cetraria cucullata, C. islandica, and C. rangiferina. Soil profiles for these sites included a mineral organic layer of 1 to 3 cm thickness. Depth to frozen soil could not be determined for these sites because of the rocky substrate.

DISCUSSION

Analysis of the data collected will be conducted this winter. Certain trends are noticeable, however. The wetter communities are definitely the most suseptible to ATV damage. In areas with the most standing water, such as tussock tundra or wet sedge meadow tundra, destruction of vegetation and depth of tracks is severe. To make matters worse, these areas have wide swaths of impact as successive ATV's attempt to bypass the previous impact. The result is rapid expansion of the trail and denuding of vegetaion. One unusual response to ATV traffic was observed in tussock tundra communities. Here the tussock clumps growing in between tracks appeared to be more robust and healthy than the surrounding tussocks. This may have been the result of increased standing or flowing water at this area of the trail. The result was an easily recognizable green trail through the tundra.

The collection of baseline data is complete at this time. A total of 113 baseline plots were established from 1996-1997. These plots represent all of the major community types present in and around Anaktuvuk Pass.

RECOMMENDATIONS

Although photo documentation of ATV impacts was started this year, it is by no means complete. This end of the project would require a separate trip just for the purpose of documenting ARGO damage. It is easy to miss even the most severe impacts if you are not hiking in the right area and with all the other duties required of this project, it was impossible to do a complete survey of these impacts. I recommend a separate trip into each drainage of interest just for this purpose.

The next step is to begin collecting data on areas already impacted by ATV use. This process was started this season and should be conducted throughout the drainages already visited. Areas close to Anaktuvuk Pass with extensive ATV damage should be the first to be sampled. These areas include Giant Creek, the lower Anaktuvuk River, and lower Kollutarak Creek. All of these areas are within 5 miles of Anaktuvuk Pass and are easy to access.

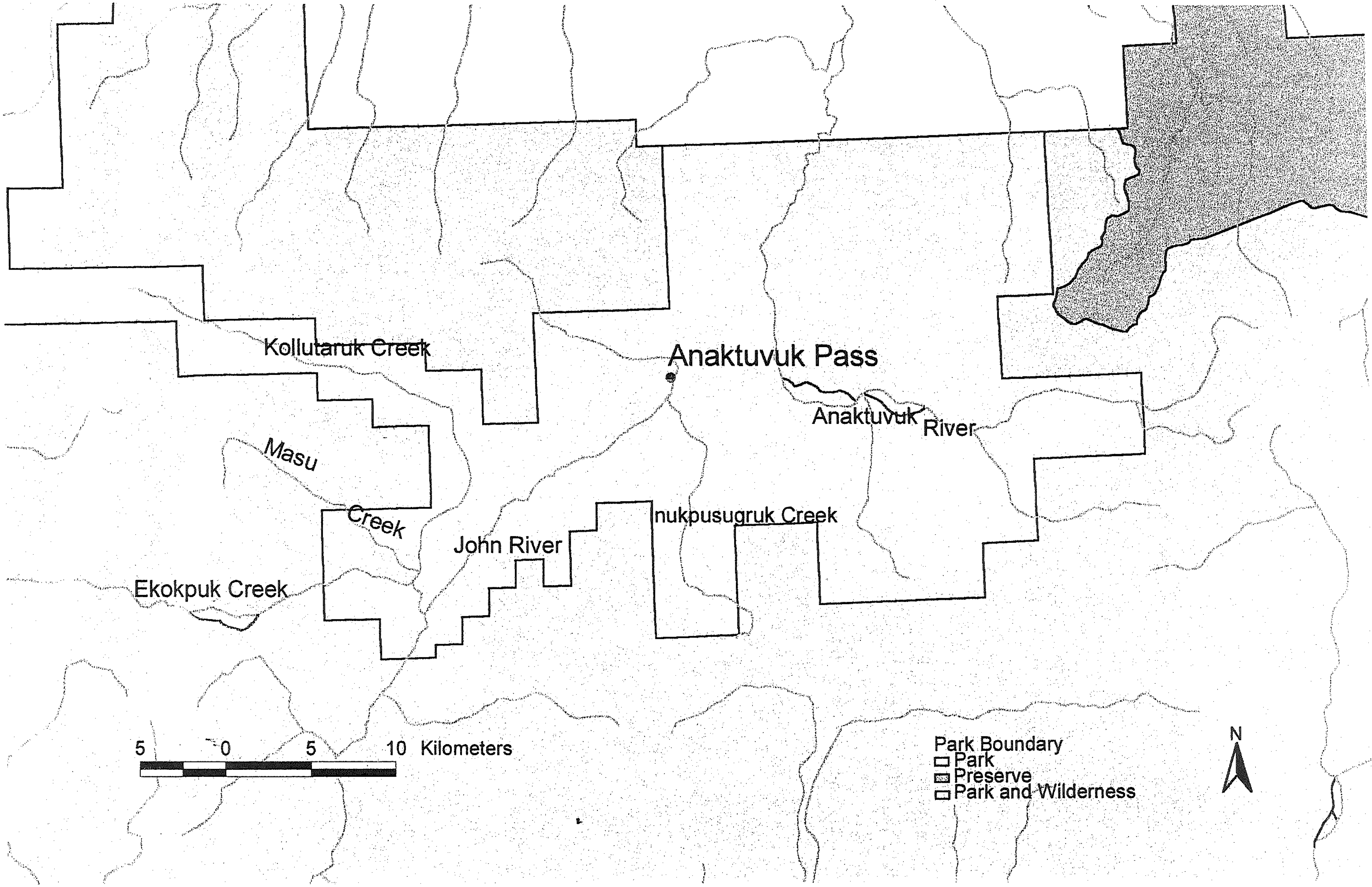


Figure 1. Location of ATV study, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, June-August 1997.

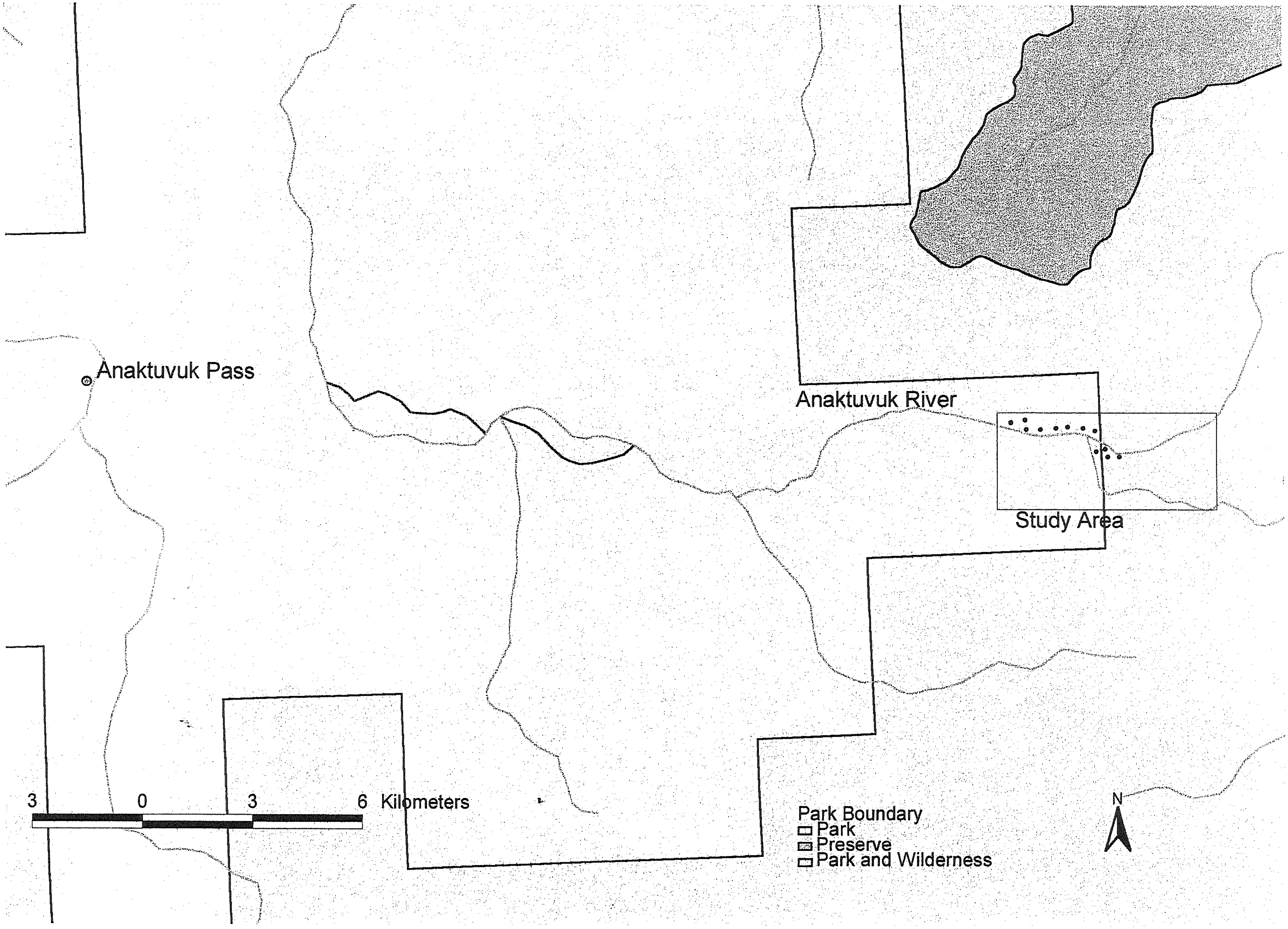
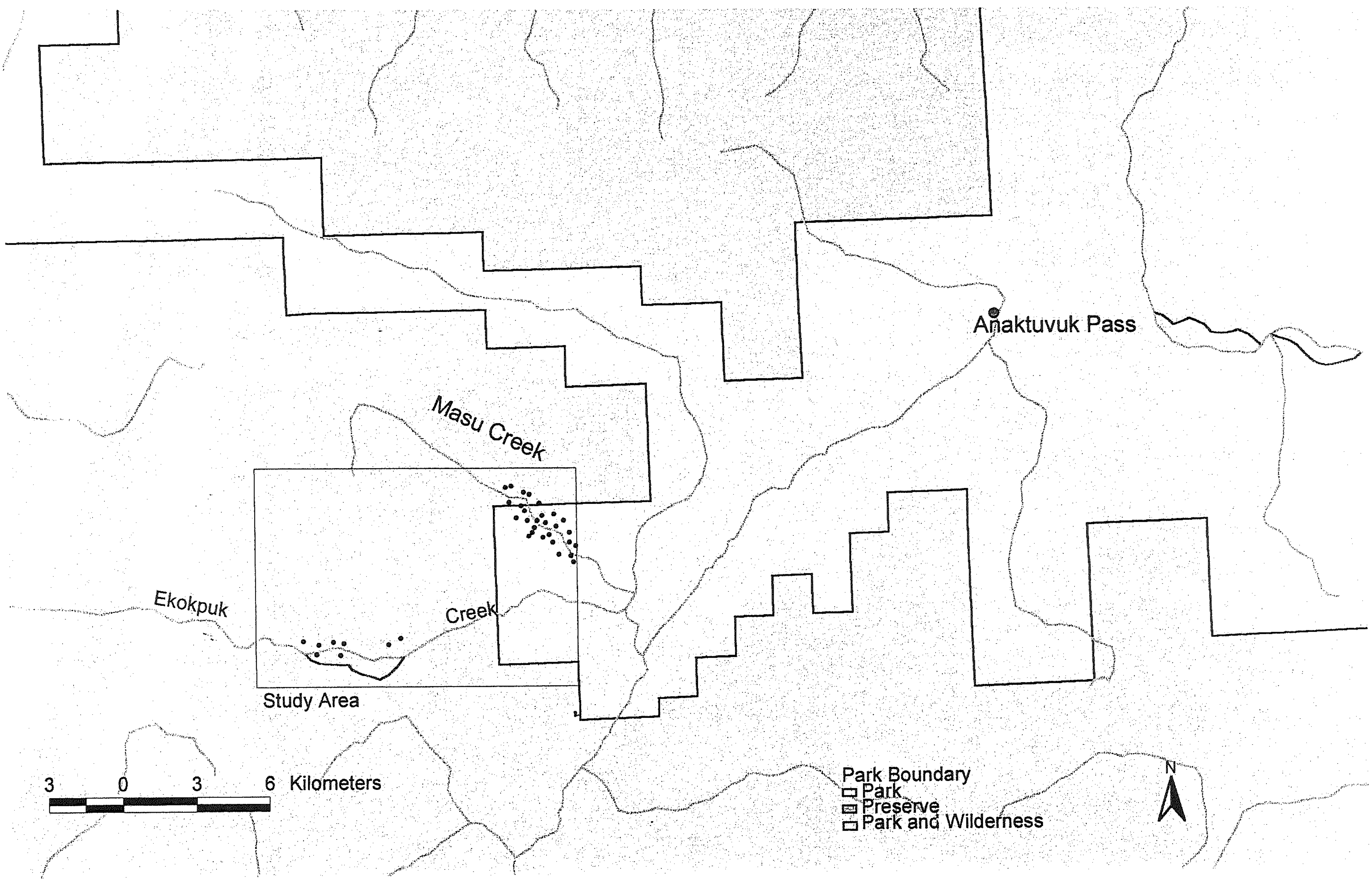


Figure 2. Location of study plots, Anaktuvuk River, Gates of the Arctic National Park and Preserve, Brooks Range, *Alaska, June 1997.*



Figrure 3. Location of study plots, Masu and Ekokpuk Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, July 1997.

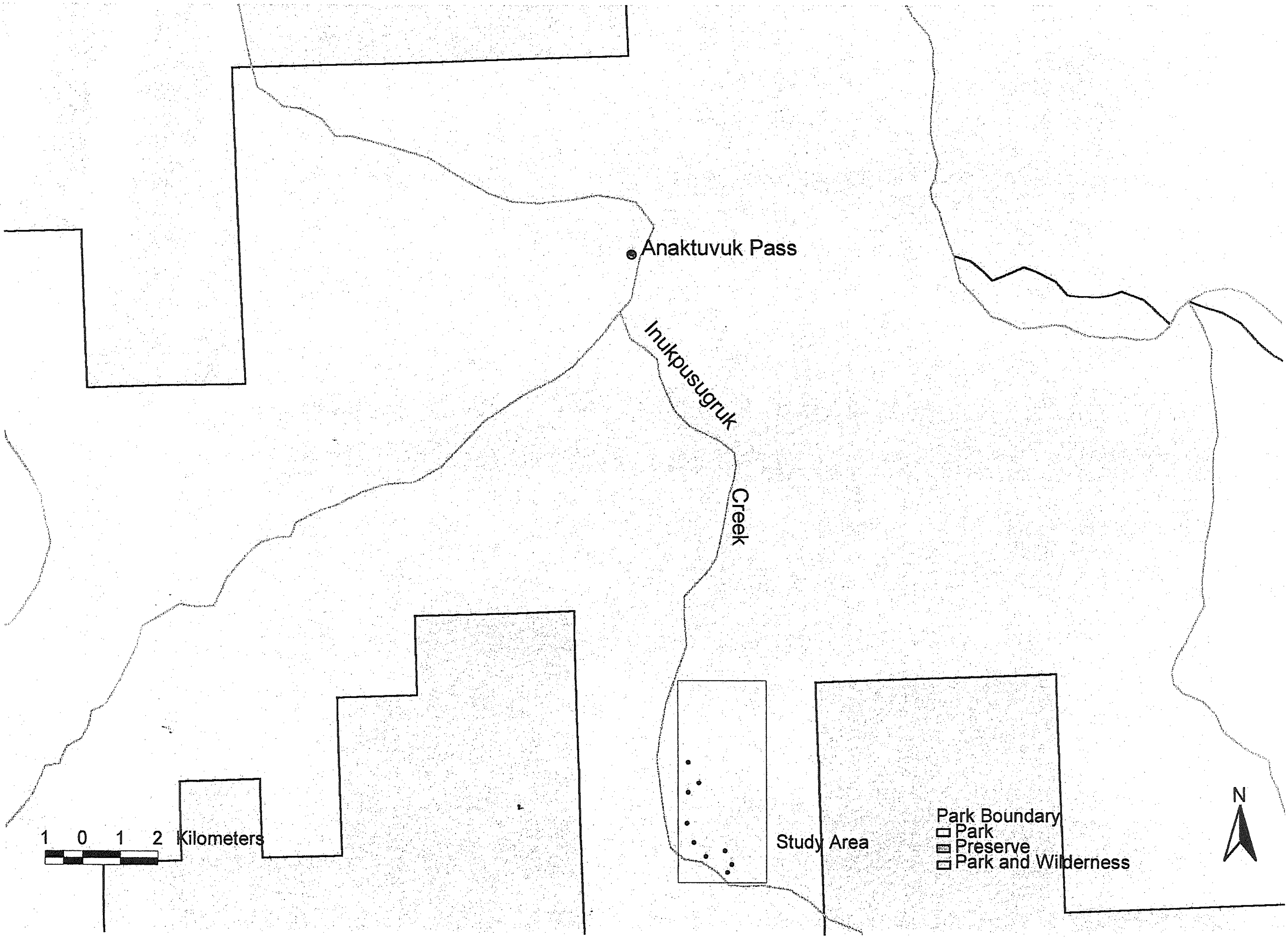


Figure 4. Location of study plots, Inukpusugruk Creek, Gates of the Arctic National Park and Preserve, *Brooks Range, Alaska, June 1997*.

Table 1. GPS positions for plots at Anaktuvuk River/Graylime Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, June 1997.

Site	Latitude (°N)	Longitude (°W)
AKP032	68° 05' 39.55"	150° 59' 03.65"
AKP033	68° 05' 38.41"	150° 59' 00.90"
AKP034	68° 05' 13.14"	150° 56' 48.71"
AKP035	68° 05' 12.33"	150° 56' 51.51"
AKP036	68° 05' 14.20"	150° 56' 52.01"
AKP037	68° 05' 14.89"	150° 56' 50.61"
AKP038	68° 07' 09.72"	151° 07' 04.36"
AKP039	68° 07' 09.33"	151° 07' 01.69"
AKP040	68° 07' 09.79"	151° 06' 58.71"
AKP041	68° 07' 09.41"	151° 07' 13.88"
AKP042	68° 07' 10.72"	151° 07' 14.02"
AKP043	68° 07' 10.94"	151° 07' 19.68"

Table 2. GPS positions for plots at Masu and Ekokpuk Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, July 1997.

Site	Latitude (^{O}N)	Longitude (^{O}W)
M001	68^{O} 04' 18.01"	152^{O} 11' 28.49"
M002	68^{O} 04' 16.11"	152^{O} 11' 30.67"
M003	68^{O} 04' 16.38"	152^{O} 11' 26.58"
M004	68^{O} 04' 13.17"	152^{O} 11' 21.67"
M005	68^{O} 04' 13.94"	152^{O} 11' 17.80"
M006	68^{O} 04' 13.42"	152^{O} 11' 10.48"
M007	68^{O} 04' 12.06"	152^{O} 11' 07.66"
M008	68^{O} 04' 09.49"	152^{O} 11' 01.60"
M009	68^{O} 04' 05.92"	152^{O} 10' 58.70"
M010	68^{O} 04' 06.87"	152^{O} 10' 56.03"
M011	68^{O} 04' 07.58"	152^{O} 10' 54.00"
M012	68^{O} 03' 44.76"	152^{O} 09' 56.83"
M013	68^{O} 03' 45.26"	152^{O} 09' 53.03"
M014	68^{O} 03' 38.55"	152^{O} 09' 16.36"
M015	68^{O} 04' 50.22"	152^{O} 12' 03.59"
M016	68^{O} 04' 39.60"	152^{O} 11' 49.84"
M017	68^{O} 04' 37.18"	152^{O} 11' 43.19"
M018	68^{O} 04' 35.84"	152^{O} 11' 39.45"
M019	68^{O} 04' 25.70"	152^{O} 11' 02.94"
M020	68^{O} 04' 26.51"	152^{O} 11' 03.39"
M021	68^{O} 04' 22.08"	152^{O} 10' 54.85"
M022	68^{O} 04' 20.95"	152^{O} 10' 49.13"
M023	68^{O} 04' 21.87"	152^{O} 10' 48.28"
M024	68^{O} 03' 37.53"	152^{O} 08' 13.97"
M025	68^{O} 03' 36.35"	152^{O} 08' 11.72"
M026	68^{O} 03' 30.90"	152^{O} 08' 23.39"
M027	68^{O} 03' 32.86"	152^{O} 08' 24.60"
EK028	68^{O} 02' 05.51"	152^{O} 15' 06.03"
EK029	68^{O} 02' 05.93"	152^{O} 15' 00.72"
EK030	68^{O} 02' 04.78"	152^{O} 14' 56.35"
EK031	68^{O} 02' 03.56"	152^{O} 14' 51.12"
EK032	68^{O} 02' 04.41"	152^{O} 14' 44.40"
EK033	68^{O} 02' 05.13"	152^{O} 14' 39.81"
EK034	68^{O} 02' 43.11"	152^{O} 11' 33.81"

Table 3. GPS positions for plots at Giant Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, June 1997.

Site	Latitude (^{O}N)	Longitude (^{O}W)
G001	68^{O} 01' 34.27"	151^{O} 41' 38.75"
G002	68^{O} 01' 35.71"	151^{O} 41' 33.60"
G003	68^{O} 01' 55.77"	151^{O} 43' 34.50"
G004	68^{O} 01' 55.33"	151^{O} 43' 37.88"
G005	68^{O} 01' 55.02"	151^{O} 43' 42.58"
G006	68^{O} 01' 52.40"	151^{O} 43' 40.79"
G007	68^{O} 01' 50.94"	151^{O} 43' 46.09"
G008	68^{O} 02' 02.30"	151^{O} 43' 44.08"
G009	68^{O} 02' 01.30"	151^{O} 43' 41.01"

Table 4. Soil horizon and texture data collected at Anaktuvuk River/Graylime Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, June 1997.

Site	Surface Texture and Thickness (cm)	Subsurface (1) Texture and Thickness (cm)	Subsurface (2) Texture and Thickness (cm)	Subsurface (3) Texture and Thickness (cm)
AKP032	O_i (21)	A-Clay Loam (4)	B-Silty Clay Loam (9)	C-Silty Clay (17)
AKP033	O_i (5)	A-Clay Loam (1)	B-Silty Clay Loam (12)	C-Silty Clay (10)
AKP034	O_i (5)	B-Silty Clay (9)	C-Silty Clay Loam (26)	-----
AKP035	O_i (9)	B-Silty Clay (9)	C-Silty Clay Loam (24)	-----
AKP036	O_i (9)	B-Silty Clay (10)	C-Silty Clay Loam (18)	-----
AKP037	O_i (10)	A-Silty Clay Loam (17)	B-Silty Clay (5)	-----
AKP038	O_i (5)	A-Silty Clay Loam (6)	C-Sandy Loam (15)	-----
AKP039	O_i (6)	A-Silty Clay Loam (6)	B-Clay Loam (4)	C-Silt Loam (19)
AKP040	O_i (5)	A-Silt Loam (7)	B-Silty Clay Loam (15)	-----
AKP041	O_i (3)	A-Silty Clay Loam (2)	-----	-----
AKP042	O_i (5)	A-Silt Loam (4)	C-Sandy Loam (6)	-----
AKP043	O_i (3)	A-Silt Loam (4)	C-Silt Loam (6)	-----

Key- O_i = Organic (fibric)

Table 5. Soil horizon and texture data collected at Masu and Ekokpuk Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, July 1997.

Site	Surface Texture and Thickness (cm)	Subsurface (1) Texture and Thickness (cm)	Subsurface (2) Texture and Thickness (cm)	Subsurface (3) Texture and Thickness (cm)
M001	O_i (1)	A- Silt Loam (1)	B- Silty Clay Loam (26)	C- Sandy Clay Loam (2)
M002	O_i (2)	A- Silt Loam (1)	B- Silty Clay Loam (2)	-----
M003	O_i (3)	B- Silty Clay Loam (12)	-----	-----
M004	O_i (16)	A- Loam (12)	-----	-----
M005	O_i (11)	A- Loam (10)	B- Silty Clay Loam (22)	-----
M006	O_i (15)	A- Loam (16)	-----	-----
M007	O_i (10)	A- Loam (6)	B- Silty Clay Loam (20)	-----
M008	O_i (10)	A- Loam (20)	-----	-----
M009	O_s (12)	A- Loam (45)	-----	-----
M010	O_s (11)	A- Silt Loam (29)	-----	-----
M011	O_s (8)	A- Silty Clay Loam (28)	-----	-----
M012	O_i (3)	A- Clay Loam (7)	-----	-----
M013	O_i (2)	A- Silt Loam (1)	B- Silty Clay Loam (13)	-----
M014	O_i (1)	A- Silt Loam (3)	B- Clay Loam (5)	-----
M015	O_i (11)	A- Sandy Clay Loam (3)	B- Loamy Sand (12)	-----
M016	O_i (5)	A- Silty Clay Loam (2)	B- Silt Loam (6)	-----
M017	O_i (3)	A- Sandy Loam (1)	B- Loamy Sand (5)	-----
M018	O_i (3)	B- Sandy Clay Loam (10)	-----	-----
M019	O_i (10)	A- Silty Clay Loam (17)	-----	-----
M020	O_i (3)	A- Silt Loam (9)	B- Silty Clay Loam (25)	-----
M021	O_i (13)	A- Silt Loam (17)	-----	-----
M022	O_i (12)	A- Silt Loam (16)	-----	-----
M023	O_i (12)	A- Silt Loam (11)	B- Silty Clay Loam (5)	-----
M024	O_i (1)	C- Sandy Loam (5)	-----	-----
M025	O_i (2)	A- Silt Loam (4)	B- Silty Clay Loam (4)	-----
M026	O_s (1)	A- Sand (10)	B- Clay Loam (29)	-----
M027	O_i (19)	B- Silty Clay Loam (28)	-----	-----
EK028	O_i (4)	A- Sandy Loam (20)	-----	-----
EK029	O_i (7)	B- Silty Clay Loam (20)	-----	-----
EK030	O_i (16)	A- Silty Clay Loam (16)	-----	-----
EK031	O_i (12)	A- Silty Clay Loam (18)	-----	-----
EK032	O_i (17)	A- Silty Clay Loam (14)	-----	-----
EK033	O_i (13)	A- Loam (19)	-----	-----
EK034	O_i (3)	A- Silty Clay Loam (10)	-----	-----

Key- O_i = Organic (fibric), O_s = Organic (sapric)

Table 6. Soil horizon and texture data collected at Giant Creek, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, June 1997.

Site	Surface Texture and Thickness (cm)	Subsurface (1) Thickness and Texture (cm)	Subsurface (2) Thickness and Texture (cm)	Subsurface (3) Thickness and Texture (cm)
G001	O_i (25)	-----	-----	-----
G002	O_i (10)	A- Clay Loam (10)	-----	-----
G003	O_i (8)	A- Clay Loam (10)	B- Silty Clay Loam (8)	-----
G004	O_i (14)	A- Clay Loam (14)	-----	-----
G005	O_i (15)	A- Clay Loam (10)	-----	-----
G006	O_i (11)	A- Clay Loam (9)	-----	-----
G007	O_i (8)	A- Clay Loam (2)	B- Silty Clay Loam (16)	-----
G008	O_i (12)	A- Clay Loam (9)	B- Silty Clay	-----
G009	O_i (16)	A- Clay Loam (9)	B- Silty Clay (21)	-----

Key- O_i = Organic (fibric)

Table 7. Plant list for ATV vegetation impact study, Anaktuvuk Pass, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 1996-1997.

CODE	Plant Name
ACDE	Aconitium delphifolium
ANPA	Anemone parviflora
ANPO	Andromeda polifolia
ARAL	Arctostaphylos alpina
ARAR	Artemesia arctica
ARGL	Artemesia glomerata
ARLA	Arctagrostis latifolia
ARLY	Arabis lyrata
ARRU	Arctostaphylos rubra
Arspp.	Arabis spp.
ARTI	Artemisia tilesii
ASAL	Astragalus alpinus
ASCH	Asahinia chrysantha
ASSI	Aster sibiricus
ASUM	Astragalus umbellatus
BENA	Betula nana
BORI	Boykinia richardsonii
CAAQ	Carex aquatilis
CABI	Carex bigelowii
CACA	Calamagrostis canadensis
CAHY	Castilleja hyperborea
CANE	Carex nesophila
CAPL	Carex pleuroflora
CAPO	Carex podocarpa
CARO	Carex rotundata
CASC	Carex scirpoidea
Caspp.	Carex spp.
CAST	Carex stylosa
CATE	Cassiope tetragona
CAUN	Campanula uniflora
CECU	Cetraria cucullata
CENI	Cetraria nivalis
CHTE	Chrysosplenium tetrandum
CLNI	Cladonia nivalis
DOFR	Dodecatheon frigidum
DRIN	Dryas integrifolia
EMNI	Empetrum nigrum
EPAN	Epilobium angustifolium
EPLA	Epilobium latifolium
EQAR	Equisetum arvense
EQVA	Equisetum variegatum
ERAN	Eriophorum angustifolium
ERRU	Eriophorum russeolum
Erspp.	Eriophorum spp.
ERVA	Eriophorum vaginatum
FEAL	Festuca altaica
FERU	Festuca rubra
GEGLI	Geum glaciale

Table 7 (Cont.)

CODE	Plant Name
GEGL	Gentiana glauca
GERO	Geum rosii
HEAL	Hedysarum alpinum
HIAL	Hierchloe alpina
JUCA	Juncus castaneus
MARI	Masonhalea richardsonii
MIAR	Minuartia arctica
OXCA	Oxytropis campestris
OXMA	Oxytopis maydelliana
OXNI	Oxytropis nigrscens
PALA	Papaver lapponicum
PANU	Parrya nudicaulis
PAPA	Parnassia palustris
PEFR	Petasites frigidum
PEKA	Pedicularis kanei
PELAB	Pedicularis labradorica
PELAN	Pedicularis langsdorfii
Pespp.	Pedicularis spp.
PESU	Pedicularis sudetica
POAC	Polemonium acutiflorum
POAL	Poa alpigena
POAR	Poa arctica
POBI	Polygonum bistorta
POBI1	Potentilla biflora
POFR	Potentilla fruticosa
POUN	Potentilla uniflora
POVI	Polygonum viviparum
PYGR	Pyrola grandiflora
RHLA	Rhododendron lapponicum
RUAR	Rumex arcticus
SAAL	Salix alaxensis
SAAN	Saussurea angustifolia
SAAR	Salix arctica
SAFU	Salix fuscecens
SAGL	Salix glauca
SAHI	Saxifraga hieracifolia
SAHI1	Saxifraga hirculus
SALA	Salix lanata
SAOP	Saxifraga oppositifolia
SAPH	Salix phlebophylla
SAPU	Salix pulchra
SAPU1	Saxifraga punctata
SARE	Salix reticulata
SELU	Senecio lugens
SHCA	Shepherdia canadensis
SIAC	Silene acaulis
SOMU	Solidago multiradiata
STCR	Stellaria crassifolia
STTO	Stereocaulon tomentosum

Table 7 (Cont.)

CODE	Plant Name
TRSP	Trisetum spicatum
VACA	Valeriana capitata
VAUL	Vaccinium uliginosum
VAVI	Vaccinium vitis-idaea
WIPH	Wilhelmsia physodes

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Appendix A. ATV study data form, Anaktuvuk Pass, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 1997.

ANAKTUVUK PASS ATV IMPACT STUDY: VEGETATION AND SOIL SURVEY

Plot # ________ Date__________ Observers________________

Plot Location:___ o ______ ' ______ " N; ___ o ______ ' ______ "W

Vegetation Type: ______________________________

Vegetation

_______Anemone narcissiflora
_______Andromeda polifolia
_______Betula glandulosa
_______Betula nana
_______Calamagrostis canadensis
_______Carex bigelowii
_______Cassiope tetragona
_______Dryas drummondii
_______Dryas integrifolia
_______Empetrum nigrum
_______Epilobium latifolium
_______Eriophorum vaginatum
_______Ledum palustre
_______Rubus chamaemorus
_______Salix lanata
_______Salix pulchra
_______Salix reticulata
_______Vaccinium uliginosum
_______Vaccinium vitis-idaea
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Lichens

_______Cetraria cucullata
_______Cetraria nivalis
_______Cetraria islandica
_______Cladina rangifera
_______Cladina rangiferina
_______Cladina stellaris
_______Nephroma arcticum
____
____
____
____

Environmental Variables

_______Slope (deg)
_______Aspect (deg True N)
_______Elevation (m)
_______% Total Vascular Cover
    _______% Shrub Cover
    _______% Forb Cover
_______% Total Lichen Cover
_______% Total Bryophyte Cover
_______Mean Shrub Height (cm)
_______% Cover Litter
_______% Cover Bare Soil
_______% Standing Water
_______% Rock

Comments/Drawing:

Impacts

_______Evidence of ATV traffic
_______% Shrub Damage
_______% Cover shrubs damaged
_______% Cover abraded shrubs

_______Disturbance Level
_______Soil Exposed
_______Microrelief
_______Visual Desciption

Soils

Surficial Geology: organic mineral gravel bedrock

Surface Texture and approx. thickness (cm)

____

Subsurface (1) Texture and approx. thickness (cm)

____

Subsurface (2) Texture and approx. thickness (cm)

____

Subsurface (3) Texture and approx. thickness (cm)

____

Subsurface (4) Texture and approx. thickness (cm)

____

Topographic position: ridge midslope lowerslope valley bottom riparian

Thickness of organic surface layer (cm) __________

Depth to (cm):
________bedrock
________permafrost
________water table
________saturated soil
________gleying
________high chroma mottles

Buried organic horizon? (Y or N) ________

Evidence of flooding (Y or N) __________
If yes, flooding > 1x/yr? (Y or N) ________

Appendix B. Disturbance Rating Scale for ATV study, Anaktuvuk Pass, Gates of the Arctic National Park and Preserve, Brooks Range, Alaska, 1997.

Disturbance Level	Description

Vegetation:

1	Undamaged; no discernible change
2	Slight compression; leaves or stems temporarily bent or rearranged; vehicle passage barely perceptible.
3	Mosses, graminoids and other herbaceous species compressed and leaves flattened; shrub stems becoming compressed.
4	Leaves or mosses and lichens torn or removed; woody shrub stems flattened, with some breakage and abrasion.
5	11-25% of original vegetation composition not discernible.
6	26-50% not discernible,
7	51-75% not discernible
8	76-100% not discernible

Soil:

1	None exposed	5	26-50% exposed
2	1-5% exposed	6	51-75% exposed
3	6-10% exposed	7	76-90% exposed
4	11-25% exposed	8	91-100% exposed

Microrelief:

1	No discernible change or depression of the surface
2	Tracks evident but with less than half of track depressed 1 inch; slight compression of tussocks or hummocks.
3	Surface depression less than 1 inch over majority of track; slight to moderate compression of tussocks or hummocks.
4	Track depressed 1-2 inches; moderate tussock or hummock compression.
5	Track depressed 2-4 inches; moderate to severe tussock or hummock compression.
6	Track depressed 4-6 inches; severe tussock or hummock depression.
7	Track depressed 6-8 inches; severe compression or destruction of tussocks or hummocks.
8	Depression or ruts greater than 8 inches deep; tussocks or hummocks completely flattened or destroyed.

Impact level determined by adding up the 3 categories of impacts: high (20-24), moderate (10-19), and low (0-9). Taken from Sinnott (1990).